Impact of coronial investigations on manner and cause of death determinations in Australia, 2000–2007

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ABSTRACT

Objective: To evaluate the changes in the understanding of the manner and cause of death occurring during the course of coronial investigations.

Design: Retrospective analysis of deaths reported to coroners in Australia between 1 July 2000 and 31 December 2007, using the National Coroners Information System.

Main outcome measures: (i) Manner of death (natural, external, unknown); (ii) intent classification (eg, unintentional injury, suicide, assault) among deaths with external causes; and, (iii) changes in the manner of death and intent classification between the presumption made at case notification and the coroner's final determination.

Results: The coronial investigation changed the presumption about manner of death or intent classification in 5.2% (6222/120 452) of cases in which a presumption was made. Among deaths with a change in attribution from natural causes to external causes, unintentional falls (442/1891) and pharmaceutical poisoning (427/1891) each accounted for 23%. Among deaths with attribution changing from external causes to natural causes, the leading medical causes of death were cardiovascular compromise (551/842; 65%) and infection (124/842; 15%). Of deaths understood correctly at notification to be due to external causes, but the wrong external cause, 34% (206/600) were ultimately judged to be unintentional injuries, and 22% (133/600) were judged to be suicides.

Conclusions: Coronial investigations transform basic understanding of cause of death in only a small minority of cases. However, the benefits to families and society of accurate cause-of-death determinations in these difficult cases may be considerable.

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Coroners' courts in the United Kingdom and countries of the British Commonwealth, including Australia, Canada, and New Zealand, have much in common.[1,2] Fatalities that occur in designated circumstances must be reported to the coroner, who investigates the manner, cause and circumstances of those deaths. The process is judicial, although it relies heavily on medical evidence. Unlike most other jurisdictions in the justice systems of these countries, the approach is inquisitorial, not adversarial. A coroner's investigation may include an inquest, but most do not.[2]

In Australia, coroners' courts are state-based jurisdictions. The nature of reportable deaths differs slightly across the six states and two territories. In general, unexpected, unnatural or violent deaths must be reported, including those related to an injury or accident. Deaths occurring while a person is held in a state facility must be reported, as must certain operative deaths and most deaths in which the identity of the deceased or the cause of death is unknown.

The performance of clinical services serving coroners' courts, particularly pathology and toxicology, has been well studied, as have death certification and reporting behaviour of doctors.[3-5] By contrast, there has been very limited empirical investigation of how coroners themselves function and make decisions.[2,6,7] This knowledge gap is surprising in Australia, given the remarkably high public profile of coronial work here.[8]

A new national repository of coronial cases — to our knowledge, the first database of its kind anywhere — has created opportunities for such research in Australia.[9] In our study, we use this database to investigate how frequently, and for what types of deaths, the understanding of the manner and cause of death changes between the time a report arrives at a coroner's court and the completion of the coroner's investigation. We hypothesised that it would be quite rare for the coronial process to introduce substantial change to what was presumed at the time of notification, on the basis of police reports, initial medical opinion, and other circumstantial information. Nonetheless, better recognition of the circumstances in which coronial investigations substantively alter the perceived manner and cause of death may help focus the attention of coroners, pathologists and others on cases with misleading first appearances. More generally, this information should highlight the types of cases in which the coronial process serves a particularly important function.

METHODS

National Coroners Information System

Data for our study came from the National Coroners Information System (NCIS), a national system of information and supporting infrastructure for use by coroners, researchers and others interested in prevention of injury and disease.[9] The dataset, which is managed by the Victorian Institute of Forensic Medicine, captures details of all deaths reported to Australian state and territory coroners, and coronial cases. Data entry is performed at local coroners' offices by coronial clerks who have direct access to the case files. A core set of data fields is then uploaded regularly to the NCIS from the local case management systems.

Data entry activities are guided by detailed coding protocols[10] and occur within a quality assurance framework.[9,11] Tests of the reliability of the dataset demonstrated strong consistency with official national statistics.[12,13] Our study was approved by the ethics committee of the Department of Justice in Victoria.

Manner and cause of death variables and terminology

NCIS records three key determinations by coroners in relation to cause of death. One variable indicates whether the death is due to natural, external or unknown causes. A second variable lists the registrable cause(s) of death. This is the pathophysiological mechanism of death, which normally comes directly from the autopsy report. A third variable, reserved only for deaths judged to be due to external causes, indicates the type of external cause from among 10 options (unintentional injury, suicide, assault, legal intervention, operations of war, complications of medical or surgical care, other, undetermined, still enquiring, and unlikely to be known).

In our report, the following terminology is used: "manner of death" — the decision

1 Characteristics of deaths notified to coroners in Australia, 1 July 2000 – 31 December 2007 ($n = 122\,494$)

Characteristic	No. (%)
Deceased person	
Sex and age (years)	
Male	79 308 (64.7%)
< 18	5 196 (4.2%)
18–45	29 474 (24.1%)
46–64	31 698 (25.9)
65 and over	55 888 (45.6%)
Marital status	
Married	42 640 (34.8%)
Never married	24 517 (20.0%)
Divorced or separated	9 539 (7.8%)
Widowed	8 990 (7.3%)
Not known	36 808 (30.0%)
Employment status	
Retired/pensioner	64 650 (52.8%)
Employed	29 028 (23.7%)
Unemployed	11 070 (9.0%)
Other	10 090 (8.2%)
Not known	7 656 (6.3%)
Case descriptor	
Notification year	
2000–02	43 483 (35.5%)
2003–05	51 898 (42.4%)
2006–07	27 113 (22.1%)
State/territory jurisdiction	
New South Wales	34 383 (28.1%)
Victoria	30 474 (24.9%)
South Australia	23 008 (18.8%)
Queensland	15 904 (13.0%)
Western Australia	10 651 (8.7%)
Tasmania	3 499 (2.9%)
Australian Capital Territory	2 356 (1.9%)
Northern Territory	2 219 (1.8%)
Coroner's decision	
Inquest held	13 075 (10.7%)
Manner of death	
Natural	77 269 (63.1%)
External	43 489 (35.5%)
Cannot be determined	1 736 (1.4%)

2 Comparison of manner of death presumed at notification with manner of death established at closure of coronial investigation in cases in which a presumption was made ($n = 120\,452$)*

Presumed manner of death	Number (%)	Coronial investigation	Established manner of death	No. (% of category total)
Natural	75 801 (62.9%)	→	Natural	73 521 (97.0%)
			External	1 891 (2.5%)
			Unknown	389 (0.5%)
External	41 286 (34.3%)	→	External	40 314 (97.6%)
			Natural	842 (2.0%)
			Unknown	130 (0.3%)
Unlikely to be known	3 365 (2.8%)	→	Natural	1 672 (49.7%)
			External	698 (20.7%)
			Unknown	995 (29.6%)

* In 2042 of the total of 122 494 cases, a presumption was not made. These cases were designated: "still enquiring" (1 977 [1.6%]); "body not recovered" (59 [< 0.1%]); and "missing" (6 [< 0.1%]). ◆

about natural versus external causes; "medical cause" — the decision regarding the registrable cause of death; and, following NCIS terminology, the "intent" is the classification of external cause. We use the term "cause of death" non-specifically in discussion to refer to any or all of these three dimensions of how deaths occur.

Manner of death and intent enter the NCIS at two time points. Coroners' clerks code manner of death when the death is reported (or "notified") to the coroner, which normally occurs within 24 hours of death or discovery of the body; for deaths presumed to have external causes, an intent classification is also made at this time. These preliminary determinations are based on information available at the time of notification — typically, a police report of the events leading to the death, or information from the medical practitioner who attended the death or examined the deceased. At the completion of the case, final determinations are made about the manner of death and the intent (if applicable), as well as the medical cause. Each of these decisions, which reflect the outcome of the coronial investigation, is recorded in the NCIS, which retains both the preliminary and the final determinations.

Study sample

We extracted information from the NCIS on all case notifications ($n = 122\,494$) made to coroners in Australia, between 1 July 2000 and 31 December 2007, for which the coronial investigation was closed on 15 January 2009, the date of extraction. The variables of interest were the manner of death, the intent classification, the medical cause of death, sociodemographic characteristics of the person who died (sex, age, marital status, employment status, residential address) and several case descriptors (eg, notification year, jurisdiction, inquest/no inquest).

Analysis

We analysed how frequently and for what types of cases the manner of death and classification of intent changed between what was presumed at notification and what was finally determined by the coroner. We were particularly interested in cases with manner of death determinations that changed from external to natural causes, and vice versa. All analyses were conducted using Stata statistical software, version 10.0 (StataCorp, College Station, Tex, USA).

RESULTS

Sample characteristics (Box 1)

Two-thirds of the deceased were male and nearly half were ⩾ 65 years of age. About a third were married and more than half were retirees or pensioners at the time of death.

New South Wales and Victoria accounted for 52.9% of all reported deaths. The caseload within each jurisdiction followed the rank order of population size, except for South Australia, which had a population of 1.6 million at the last census (2006), but more coronial notifications than the more populous states of Queensland (4.1 million) and Western Australia (2.1 million).

The coroner determined that the manner of death was natural causes in 63.1% of cases and external causes in 35.5%. The investigation included an inquest in 10.7% of cases.

3 Deaths due to external causes among those presumed at notification to be due to natural causes (left side), and deaths due to natural causes among those presumed at notification to be due to external causes (right side)*

Natural → external ($n = 1891$)	No. (%)	External → natural ($n = 842$)	No. (%)
• Unintentional injury	1340 (70.9%)	• Cardiovascular	551 (65.4%)
Fall	442 (23.4%)	Ischaemic heart disease	264 (31.4%)
Poisoning by pharmaceutical(s)	264 (14.0%)	Congestive heart failure, arrhythmias	103 (12.2%)
Alcohol toxicity	152 (8.0%)	Cerebrovascular disease	89 (10.6%)
Asphyxiation on food or vomit	136 (7.2%)	Other haemorrhage, vessel dysfunction	39 (4.6%)
Transport accident	85 (4.5%)	Inflammatory heart disease	20 (2.4%)
Asbestos exposure	62 (3.3%)	Other	36 (4.3%)
• Adverse event due to medical care	312 (16.5%)	• Infection	124 (14.7%)
Complications of surgery	154 (8.1%)	Pneumonia	93 (11.0%)
Complications of medical procedures	74 (3.9%)	Sepsis	24 (2.9%)
Adverse drug event	47 (2.5%)	Other	7 (0.8%)
Other adverse events	37 (2.0%)	• Gastrointestinal	32 (3.8%)
• Suicide	135 (7.1%)	Liver failure	18 (2.1%)
Poisoning by pharmaceutical(s)	91 (4.8%)	Bowel obstruction, necrosis	7 (0.8%)
Multiple substances	51 (2.7%)	Other	7 (0.8%)
Antidepressants	15 (0.8%)	• Respiratory disease	34 (4.0%)
Asphyxia by hanging	14 (0.7%)	• Cancer	18 (2.1%)
Poisoning by other means	15 (0.8%)	• Other	67 (8.0%)
• Unknown intentionality	93 (4.9%)	• Indeterminate	16 (1.9%)
Poisoning by pharmaceutical(s)	72 (3.8%)		

*All categories in the natural → external causes group are shown except "Assault" (7) and "Other" (4), and leading subcategories are shown. All categories and subcategories in the external → natural causes group are shown. ◆

Frequency of transitions in understanding of cause of death

The vast majority of presumptions about natural and external causes as the manner of death (97.0% and 97.6%, respectively) were confirmed as such by the coronial investigation (Box 2). However, 70.4% (2370/3365) of deaths in which it was anticipated that the manner of death would be unlikely to be known were subsequently determined by the coroner to be due to natural or external causes. In 1.7% of deaths notified ($n = 2042$), no presumption was made, as enquiries were still in train or the body had not been recovered.

There were six main groups of transitions in understanding of cause of death between the time of notification and case closure, namely: natural to external; natural to unknown; external to natural; external to unknown; unlikely to be known to natural; and unlikely to be known to external. An additional transition in understanding, not shown in Box 2, involved deaths presumed at notification to be due to external causes, and confirmed as such by the coronial investigation, but which changed with respect to their intent classification (eg, unintentional injury to suicide). In aggregate, one of these seven types of transition occurred in 5.2% (6222/120 452) of cases in which a presumption was made. Cases in which there was an initial presumption that cause was unlikely to be known accounted for 38.1% (2370/6222) of these transitions.

Among deaths presumed to be due to natural causes, transitions to external causes were infrequent, occurring in only 2.5% (1891/75 801) of cases. Similarly, among cases presumed to be due to external causes, transitions to natural causes occurred in only 2.0% (842/41 286) of cases. Among deaths understood throughout to be due to external causes, 1.8% (735/40 314) experienced a change in their intent classification. Box 3 and Box 4 provide more specific information about causes of death in each of these three main transition groups.

Nature of transitions in understanding

Unintentional falls accounted for 23.4% of deaths in the natural-to-external transition group (Box 3, left side). Other leading categories in this group were unintentional deaths by pharmaceutical poisoning, alcohol toxicity, asphyxiation on food or vomit, and complications of surgery. In total, poisoning by pharmaceuticals accounted for 22.6% (427/1891) of cases in the natural-to-external group (Box 3).

The medical cause of death for the majority of cases in the external-to-natural group was cardiovascular compromise (65.4%), chiefly ischaemic heart disease, congestive heart failure/arrhythmia and cerebrovascular disease (Box 3, right side). Infection (14.7%) was the next most prevalent medical cause in this group, with pneumonia (11.0%) the leading type of infection.

The 10 most prevalent changes in the intent classification are listed in Box 4. Collectively, they account for 83.2% (499/600) of the cases in this group. Thirty-four per cent of these transitions involved deaths by unintentional injury, originally construed as deaths due to unknown causes (16.7%), suicide (12.3%) or assault (5.3%). Twenty-two per cent were suicides originally construed as deaths due to unknown causes (8.2%), unintentional injury (8.0%), or assault (6.0%).

DISCUSSION

Our study attempted to get inside the "black box" of the coronial process in Australia by examining its impact on cause of death determinations. The coroner's role in establishing cause of death is especially valuable for fatalities in which the fundamental cause is obscure, or first impressions are misleading. We found that in about 1 in 20 deaths reported to coroners in Australia between 2000 and 2007 there was a change in the basic understanding of the manner of death or type of external cause during the course of the coronial investigation.

Few empirical studies in Australia[14,15] or elsewhere[6,7] have investigated the processes of coronial decision making. Explanations for this paucity of research include the absence of a public health tradition within coronership, data constraints (at least before the establishment of the NCIS), and, perhaps most importantly, a general disinterest among courts and legal scholars in tracking and analysing cases at the "population" level.

The task of establishing cause of death has been regarded as an important public function in civil society since the middle ages.[16] Today, many considerations — public health, social justice, the integrity of vital statistics, and concern for families and friends of the deceased — dictate that getting cause-of-death determinations right is crucial in a well functioning society. But it is

4 Ten most prevalent transitions in intent classifications between death notification and closure of the coronial investigation ($n = 600$*)

Intent transitions	No. (%)
Unknown intent → unintentional injury	100 (16.7%)
Suicide → unintentional injury	74 (12.3%)
Unintentional injury → medical adverse event	57 (9.5%)
Unknown intent → suicide	49 (8.2%)
Unintentional injury → suicide	48 (8.0%)
Unintentional injury → unknown intent	44 (7.3%)
Suicide → unknown intent	37 (6.2%)
Assault → suicide	36 (6.0%)
Assault → unintentional injury	32 (5.3%)
Unintentional injury → assault	22 (3.7%)

* Excludes 135 cases in which no presumption about intent was made because basic enquiries were still underway at the time of notification. ◆

a formidable challenge. Coroners have limited manpower and resources and most deal with large caseloads — Australia-wide, about 18 000 deaths per annum are reported to coroners. Therefore, high performance in accurately identifying causes of death requires prudent allocation of available time and directing effort towards deaths requiring close investigation. Findings from studies like this one may improve coroners' ability to identify such cases.

Our study has several limitations. First, the manner and intent categories that form the basis of our transition measurements are broad. More detailed information on the nature, cause and circumstances of death may emerge during the course of a coronial investigation, and have substantial value to families and society.

Second, NCIS coding instructions stipulate that coronial clerks should classify the causes as they are understood "at the time of notification to the coroner" and this "should not be updated throughout or at the completion of the coronial investigation".[10] To the extent that this instruction was breached, and late coding or revisions occurred that were not caught by the NCIS's quality assurance procedures, the presumed and final causes will more closely resemble one another. The effect on our estimates of the frequency of transitions from one cause classification to another would be to render them an underestimate; the effect on findings related to the mix of cases in which transitions occur is unknown.

Finally, cases notified up to the end of 2007 were eligible for our study sample provided they were closed. At the date we extracted the sample from the NCIS, 93% of all NCIS cases notified through to 31 December 2007 had closed, but only 84% of notifications in 2007 had closed, creating a potential source of bias. We re-ran the analyses restricting the case sample to those notified through to the end of 2005, which meant 95% of 2005 notifications and 95% of 2000–2005 notifications had closed by the date of extraction. This reduced the sample size by 30%, but the rates and proportions forming our main study findings were essentially unchanged.

In summary, findings from this study indicate that coronial investigations in Australia change basic presumptions about how deaths occur in only a small minority of cases. Those changes, when they occur, may be very important to the families involved. At a whole-of-caseload level, however, our findings raise questions about whether the role of coroners' courts can be justified solely or principally by focusing on their function as establishers of cause of death, traditionally the coroner's core activity.

In the past few years, an important period of coronial law reform has begun globally.[3,17,18] The most significant reforms involve elevating the importance of the non-traditional functions of coroners — for example, helping families to understand and cope with the death of loved ones, and formulating public-health recommendations and monitoring their implementation. These functions may eventually grow to eclipse death certification as the coroner's chief contribution to society.

COMPETING INTERESTS

Stephen Cordner is a Director and a member of the Board of the Victorian Institute of Forensic Medicine (VIFM). The VIFM was instrumental in establishing the NCIS (the dataset used in this analysis) and currently operates this data system.

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